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10/673,529	09/29/2003	Shachar Fienblit	IL920030032US1	1832
<div>7590 09/24/2007 Stephen C. Kaufman Intellectual Property Law Dept. IBM Corporation P.O. Box 218 Yorktown Heights, NY 10598</div>			<div>EXAMINER COLAN, GIOVANNA B</div>	
			<div>ART UNIT 2162</div>	<div>PAPER NUMBER</div>
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/673,529

Applicant(s)

FIENBLIT ET AL.

Examiner

Giovanna Colan

Art Unit

2162

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 June 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-48 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-48 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application
- ☐ Other: _____

DETAILED ACTION

1. This action is issued in response to the Amendment filed on 06/26/2007.
2. Claims 1, 17, and 33 were amended. No claims were canceled. No claims were added.
3. This action is made Final.
4. Claims 1–48 are pending in this application.
5. Applicant's arguments with respect to amended claims 1, 17, and 33 have been considered but are moot in view of the new ground(s) of rejection.

Terminal Disclaimer

6. The terminal disclaimer filed on 07/13/2007 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date has been reviewed and is accepted. The terminal disclaimer has been recorded.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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8. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. Claim 1 – 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Black (Black hereinafter) (US Patent No. 6,978,324 B1, filed: June 27, 2000) in view of Willis et al. (Willis hereinafter) (US Patent No. 5,550,998), and further in view of Bakke et al. (Bakke hereinafter) (US Patent App. Pub. No. 2003/0023808 A1, filed: July 26, 2001).

Regarding Claim 1, Black discloses a method for managing a data storage system that includes primary (Fig. 11, item 111, Col. 19, lines 48 – 51, Black) and secondary storage subsystems (Fig. 11, item 112, Col. 19, lines 63 – 65, Black), including respective first and second storage media (Col. 18, lines 62 – 64, Black), the method comprising:

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maintaining a record of locations to which data are expected to be written on the primary storage subsystem by a host processor (Col. 27, lines 47 – 50 and 59 – 61, Black),

However, Black is silent with respect to a predetermined algorithm. On the other hand, Willis discloses maintaining a record of locations (Col. 5, lines 5 – 7, Willis), and as indicated by a predetermined prediction algorithm based on the locations to which the data have already been written (Col. 2 – 3, lines 59 – 67 and 1 – 4; respectively, Willis). It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the Willis's teachings to the system Black. Skilled artisan would have been motivated to do so, as suggested by Willis (Col. 2, lines 53 – 58, Willis), to allow time between subsequent read and write operations to be used to pre-seek the head or transducer of an idle disk drive to predetermined pre-seek write locations and pre-seek read locations to reduce the seek time for subsequent read or write operation, thereby improving performance.

Furthermore, the combination of Black in view of Willis discloses:

receiving the data from the host processor at the primary storage subsystem to be written to a specified location on the first storage media (Col. 28, lines 3 – 6, Black);

if the specified location is not included in the record, updating the record so that the record includes both the specified location and one or more further locations that have not yet been specified by the host processor (Col. 5, lines 5 – 7, Willis; and Fig. 17, item 173 and 174, Col. 25 and 28, lines 51 – 57 and 63 – 65, and 19 – 21, “the host

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mapping table may be updated at a step 154.... This would correspond to adding an entry in the table 157b ...”; respectively, Black);

outputting an acknowledge to the host processor to indicate that the data have been stored in the data storage system after receiving the data and after updating the record if the specified location was not included in the record prior to updating the record (Col. 5, lines 9 – 14, Willis; and Col. 28, lines 22 – 31, Black);

copying the data from the primary storage subsystem to the secondary storage subsystem (Fig. 21A, items 212 and 213, Col. 29, lines 4 – 9, Black); and

storing the data in the specified location on both the first (Col. 19, lines 48 – 50, Black¹) and second storage media (Col. 19, lines 63 – 65, Black).

The combination of Black in view of Willis further discloses additional storage elements (Col. 18, lines 62 – 64, Black). However, the combination of Black in view of Willis is silent with respect to a non-volatile storage media. On the other hand, Bakke discloses storing data to a non-volatile storage media (Page 1, [0011], lines 2 – 4, Bakke). It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate Bakke teachings' to the system of the combination of Black in view of Willis. Skilled artisan would have been motivated to do so, as suggested by Bakke (Page 1, [0007] and [0008], lines 10 – 12 and 1 – 3; respectively, Bakke), to mirror and backup data between storage devices while maintaining data coherency and ensuring a “flawless” takeover in the event of a failure. In addition,

Black's system and the system of the combination of Black in view of Willis are analogous art because they belong to the same field of endeavor, such as, backing up and mirroring data between a plurality of storage devices, memory allocation, and database management systems. This close relation between the references highly suggests an expectation of success.

Regarding Claim 2, the combination of Black in view of Willis and further in view of Bakke discloses a method, wherein copying the data comprises transmitting the data between mutually-remote sites over a communication link between the sites (Col. 17, lines 9 – 12, Black; and Page 1 and 4, [0009] and [0033], lines 20 – 23 and 26 – 29; respectively, Bakke).

Regarding Claim 3, the combination of Black in view of Willis and further in view of Bakke discloses a method, wherein copying the data comprises creating a mirror on the secondary storage subsystem of the data received by the primary storage subsystem (Col. 29, lines 4 – 9, Black²; and Page 1, [0009], lines 15 – 18, Bakke).

Regarding Claim 4, the combination of Black in view of Willis and further in view of Bakke discloses a method, and comprising, upon occurrence of a failure in the primary storage subsystem, configuring the secondary storage subsystem to serve as

¹ Black further discloses the step of storing the data in a specified location on the storage locations (Col. 21, lines 30 – 33, Black).

² Wherein storage element corresponds to primary storage device, and destination storage element corresponds to secondary storage device.

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the primary storage subsystem so as to receive further data from the host processor to be stored by the data storage system (Page 3, [0026], lines 23 – 32, Bakke).

Regarding Claim 5, the combination of Black in view of Willis and further in view of Bakke discloses a method, and comprising, upon recovery of the system from a failure of the primary storage subsystem, conveying, responsively to the record, a portion of the data from the secondary storage subsystem to the primary storage subsystem for storage on the primary storage subsystem (Page 6, [0044], lines 11 – 16, Bakke).

Regarding Claim 6, the combination of Black in view of Willis and further in view of Bakke discloses a method, wherein maintaining and updating the record comprise marking respective bits in a bitmap corresponding to the locations to which the data are to be written on the first and second non-volatile storage media (Col. 26, lines 20 – 25, Black³; and Page 2, [0011], lines 9 – 13, Bakke).

Regarding Claim 7, the combination of Black in view of Willis and further in view of Bakke discloses a method, wherein maintaining the record comprises storing the record on the first non-volatile storage media (Page 27, lines 47 – 50 and 59 – 61, Black), and wherein updating the record comprises modifying the record that is stored on the first non-volatile storage media (Col. 28, lines 15 – 18, Black).

Regarding Claim 8, the combination of Black in view of Willis and further in view of Bakke discloses a method, wherein modifying the record comprises:

comparing the specified location to a copy of the record held in a volatile memory on the primary storage subsystem (Col. 28, lines 7 – 8, Black);

modifying the copy of the record so that at least the specified location is included in the copy of the record (Col. 28, lines 24 – 28, Black⁴); and

destaging the modified copy of the record to the first non-volatile storage media (Col. 28, lines 24 – 25, Black⁵).

Regarding Claim 9, the combination of Black in view of Willis and further in view of Bakke discloses a method, wherein the record is not modified on the first non-volatile storage media responsively to receiving the data as long as the specified location to which the data are to be written is included in the record (Col. 28, lines 7 – 11, Black).

Regarding Claim 10, the combination of Black in view of Willis and further in view of Bakke discloses a method, wherein modifying the record comprises adding a plurality of locations, including the specified location, to the record (Col. 25, lines 60 – 63, Black).

³ Examiner interprets the step of adding a layer of mapping when the same number of bits is found, as a step for marking the bits.

⁴ Wherein the step of updating the information containing the locations and forwarding the addresses corresponds to the step of modifying the copy of the record to specify the location as claimed.

⁵ Examiner interprets the step of forwarding the new updated address (Col. 28, lines 24 – 25, Black) as the step of destaging the modified copy of the record claimed. The new updated address corresponds to the modified record. In addition, Black discloses the record of locations in the primary storage (Col. 27, lines 59 – 64, Black).

Regarding Claim 11, the combination of Black in view of Willis and further in view of Bakke discloses a method, wherein updating the record comprises predicting one or more further locations to which the host processor is expected to write the data in a subsequent write operation (Col. 25, lines 45 – 50, Black⁶), and adding the one or more further locations to the record (Col. 25, lines 60 – 63, Black).

Regarding Claim 12, the combination of Black in view of Willis and further in view of Bakke discloses a method, wherein predicting the one or more further locations comprises selecting a predetermined number of consecutive locations in proximity to the specified location (Col. 25, lines 10 – 19, Black).

Regarding Claim 13, the combination of Black in view of Willis and further in view of Bakke discloses a method, wherein maintaining the record comprises recording the locations to which the data are written using an object-based storage technique (Col. 24, lines 11 – 18, Black), and wherein predicting the one or more further locations comprises choosing the one or more further locations based on a logical connection between storage objects (Col. 24, lines 53 – 57, Black⁷).

Regarding Claim 14, the combination of Black in view of Willis and further in view of Bakke discloses a method, wherein updating the record comprises removing one or

more locations, other than the specified location, from the record, so as to limit a size of the record (Col. 21, lines 53 – 57, Black).

Regarding Claim 15, the combination of Black in view of Willis and further in view of Bakke discloses a method, wherein removing the one or more locations comprises receiving an acknowledgment from the secondary storage subsystem that the data have been stored in the one or more locations on the second non-volatile storage media (Col. 24, lines 58 – 62, Black), and removing the one or more locations from the record responsively to the acknowledgment (Col. 28, line 45, Black⁸).

Regarding Claim 16, the combination of Black in view of Willis and further in view of Bakke discloses a method, wherein removing the one or more locations comprises identifying the locations at which the first and second non-volatile storage media contain identical data (Col. 26, lines 21 – 23, Black), and selecting for removal one of the identified locations that was least-recently added to the record (Col. 24, lines 55 – 58, Black⁹).

Regarding Claim 17, the combination of Black in view of Willis and further in view of Bakke discloses a data storage system, comprising:

⁶ Examiner interprets the step of examining the table to determine the location as the step of predicting the location claimed.

⁷ Wherein permitting identification corresponds to choosing the locations claimed.

⁸ Wherein the step of releasing the memory corresponds to the step of removing the locations.

⁹ Wherein examiner interprets accessed records (disclosed by Black) as added records claimed. In addition, the removing step is cited in Col. 28, line 45, Black.

a primary storage subsystem (Fig. 11, item 111, Col. 19, lines 48 – 51, Black), which comprises first non-volatile storage media (Col. 18, lines 62 – 64, Black; and Page 1, [0011], lines 2 – 4, Bakke); and

a secondary storage subsystem (Fig. 11, item 112, Col. 19, lines 63 – 65, Black), which comprises second non-volatile storage media (Col. 18, lines 62 – 64, Black; and Page 1, [0011], lines 2 – 4, Bakke),

wherein the primary storage subsystem is arranged to receive data from a host processor for writing to a specified location (Col. 27, lines 3 – 6, Black), and to store the data in the specified location on the first non-volatile storage media while copying the data to the second storage subsystem (Fig. 21A, items 212 and 213, Col. 29, lines 4 – 9, Black; and Page 1, [0011], lines 2 – 4, Bakke), which is arranged to store the data in the specified location on the second non-volatile storage media (Col. 19, lines 63 – 65, Black), and

wherein the primary storage subsystem is arranged to maintain a record of locations to which data are expected to be written on the primary storage subsystem by the host processor (Col. 5, lines 5 – 7, Willis; and Col. 27, lines 47 – 50 and 59 – 61, Black), as indicated by a predetermined prediction algorithm based on the locations to which the data have already been written (Col. 2 – 3, lines 59 – 67 and 1 – 4; respectively, Willis), and upon receiving the data from the host processor (Col. 27, lines 47 – 50, Black), to update the record so that the record includes both the specified location and one or more further locations that have not yet been specified by the host processor if the specified location is not included in the record (Col. 5, lines 9 – 14,

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Willis; and Fig. 17, item 173 and 174, Col. 25 and 28, lines 51 – 57 and 63 – 65, and 19 – 21, “the host mapping table may be updated at a step 154.... This would correspond to adding an entry in the table 157b ...”; respectively, Black), and to output an acknowledgement to the host processor to indicate that the data have been stored in the data storage system after receiving the data and after updating the record if the specified location was not included in the record prior to updating the record (Col. 5, lines 9 – 14, Willis; and Col. 28, lines 22 – 31, Black).

Regarding Claim 18, the combination of Black in view of Willis and further in view of Bakke discloses a system, wherein the first and second non-volatile storage media are located at mutually-remote sites, and wherein the instructions cause at least one of the first and second control units to transmit the data over a communication link between the sites (Col. 17, lines 9 – 12, Black; and Page 1 and 4, [0009] and [0033], lines 20 – 23 and 26 – 29; respectively, Bakke).

Regarding Claim 19, the combination of Black in view of Willis and further in view of Bakke discloses a system, wherein the instructions cause the first and second control units to mirror the data held by the primary storage subsystem on the secondary storage subsystem (Col. 29, lines 4 – 9, Black¹⁰; and Page 1, [0009], lines 15 – 18, Bakke).

Regarding Claim 20, the combination of Black in view of Willis and further in view of Bakke discloses a system, wherein the instructions cause the secondary storage subsystem, upon occurrence of a failure in the primary storage subsystem, to serve as the primary storage subsystem so as to receive further data from the host processor to be stored by the data storage system (Page 3, [0026], lines 23 – 32, Bakke).

Regarding Claim 21, the combination of Black in view of Willis and further in view of Bakke discloses a system, wherein upon recovery of the system from a failure of the primary storage subsystem, the instructions cause the second control unit to convey, responsively to the record, a portion of the data from the second non-volatile storage media to the primary storage subsystem for storage on the first non-volatile storage media (Page 6, [0044], lines 11 – 16, Bakke).

Regarding Claim 22, the combination of Black in view of Willis and further in view of Bakke discloses a system, wherein the record comprises a bitmap, and wherein the instructions cause the first control unit to mark respective bits in the bitmap corresponding to the locations to which the data are to be written on the first and second non-volatile storage media (Col. 26, lines 20 – 25, Black¹⁰; and Page 2, [0011], lines 9 – 13, Bakke).

¹⁰ Wherein storage element corresponds to primary storage device, and destination storage element corresponds to secondary storage device.

¹¹ Examiner interprets the step of adding a layer of mapping when the same number of bits is found, as a step for marking the bits.

Regarding Claim 23, the combination of Black in view of Willis and further in view of Bakke discloses a system, wherein the instructions cause the first control unit to store (Page 27, lines 47 – 50 and 59 – 61, Black) and update the record on the first non-volatile storage media (Col. 28, lines 15 – 18, Black).

Regarding Claim 24, the combination of Black in view of Willis and further in view of Bakke discloses a system, wherein the instructions cause the first control unit to hold a copy of the record in a volatile memory of the primary storage subsystem (Col. 28, lines 7 – 8, Black), and to update the record by modifying the copy of the record (Col. 28, lines 24 – 28, Black¹²), and destaging the modified copy of the record to the first non-volatile storage media (Col. 28, lines 24 – 25, Black¹³).

Regarding Claim 25, the combination of Black in view of Willis and further in view of Bakke discloses a system, wherein the instructions cause the first control unit not to modify the record on the first non-volatile storage media responsively to receiving the data as long as the specified location to which the data are to be written is included in the record (Col. 28, lines 7 – 11, Black).

¹² Wherein the step of updating the information containing the locations and forwarding the addresses corresponds to the step of updating the copy of the record to specify the location as claimed.

¹³ Examiner interprets the step of forwarding the new updated address (Col. 28, lines 24 – 25, Black) as the step of destaging the modified copy of the record claimed. The new updated address corresponds to the modified record. In addition, Black discloses the record of locations in the primary storage (Col. 27, lines 59 – 64, Black).

Regarding Claim 26, the combination of Black in view of Willis and further in view of Bakke discloses a system, wherein the instructions cause the first control unit, when the specified location is not included in the record, to update the record in the first non-volatile storage media by adding a plurality of locations, including the specified location, to the record (Col. 25, lines 60 – 63, Black).

Regarding Claim 27, the combination of Black in view of Willis and further in view of Bakke discloses a system, wherein the instructions cause the first control unit, when the specified location is not included in the record, to predict one or more further locations to which the host processor is expected to write the data in a subsequent write operation (Col. 25, lines 45 – 50, Black¹⁴), and to add both the specified location and the one or more further locations to the record (Col. 25, lines 60 – 63, Black).

Regarding Claim 28, the combination of Black in view of Willis and further in view of Bakke discloses a system, wherein the one or more further locations predicted by the first control unit comprise a predetermined number of consecutive locations in proximity to the specified location (Col. 25, lines 10 – 19, Black).

Regarding Claim 29, the combination of Black in view of Willis and further in view of Bakke discloses a system, wherein the instructions cause the first control unit to maintain the record using an object-based storage technique (Col. 24, lines 11 – 18,

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Black), and to predict the one or more further locations based on a logical connection between storage objects (Col. 24, lines 53 – 57, Black¹⁵).

Regarding Claim 30, the combination of Black in view of Willis and further in view of Bakke discloses a system, wherein the instructions cause the first control unit, upon updating the record, to remove one or more locations, other than the specified location, from the record, so as to limit a size of the record (Col. 21, lines 53 – 57, Black).

Regarding Claim 31, the combination of Black in view of Willis and further in view of Bakke discloses a system, wherein the instructions cause the second control unit to transmit an acknowledgment to the primary storage subsystem indicating that the data have been stored in the one or more locations on the second non-volatile storage media (Col. 24, lines 58 – 62, Black), and further cause the first control unit to remove the one or more locations from the record responsively to the acknowledgment (Col. 28, line 45, Black¹⁶).

Regarding Claim 32, the combination of Black in view of Willis and further in view of Bakke discloses a system, wherein the instructions cause the first control unit to identify the locations at which the first and second non-volatile storage media contain identical data (Col. 26, lines 21 – 23, Black), and to remove from the record one of the

¹⁴ Examiner interprets the step of examining the table to determine the location as the step of predicting the location claimed.

¹⁵ Wherein permitting identification corresponds to choosing the locations claimed.

¹⁶ Wherein the step of releasing the memory corresponds to the step of removing the locations.

identified locations that was least-recently added to the record (Col. 24, lines 55 – 58, Black¹⁷).

Regarding Claim 33, the combination of Black in view of Willis and further in view of Bakke discloses a computer software product for use in a data storage system including primary (Fig. 11, items 111, Col. 19, lines 48 – 51, Black) and secondary storage subsystems (Fig. 11, items 112, Col. 19, lines 63 – 65, Black), which include respective first and second control units (Col. 18, lines 25 – 29, Black) and respective first and second non-volatile storage media (Col. 18, lines 62 – 64, Black; and Page 1, [0011], lines 2 – 4, Bakke), the product comprising a computer-readable medium in which program instructions are stored, which instructions, when read by the first and second control units, cause the first control unit to receive data from a host processor for writing to a specified location (Col. 27, lines 3 – 6, Black), and to store the data in the specified location on the first non-volatile storage media while copying the data to the second storage subsystem (Fig. 21A, items 212 and 213, Col. 29, lines 4 – 9, Black; and Page 1, [0011], lines 2 – 4, Bakke), and cause the second control unit to store the data in the specified location on the second non-volatile storage media (Col. 19, lines 63 – 65, Black),

wherein the instructions further cause the first control unit to maintain a record of locations to which data are expected to be written on the primary storage subsystem by the host processor (Col. 5, lines 5 – 7, Willis; and Col. 27, lines 47 – 50 and 59 – 61,

¹⁷ Wherein examiner interprets accessed records (disclosed by Black) as added records claimed. In

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Black), as indicated by a predetermined prediction algorithm based on the locations to which the data have already been written (Col. 2 – 3, lines 59 – 67 and 1 – 4; respectively, Willis), and upon receiving the data from the host processor (Col. 27, lines 47 – 50, Black), to update the record so that the record includes both the specified location and one or more further locations that have not yet been specified by the host processor if the specified location is not included in the record (Col. 5, lines 9 – 14, Willis; and Fig. 17, item 173 and 174, Col. 25 and 28, lines 51 – 57 and 63 – 65, and 19 – 21, “the host mapping table may be updated at a step 154.... This would correspond to adding an entry in the table 157b ...”; respectively, Black), and to output an acknowledgement to the host processor to indicate that the data have been stored in the data storage system after receiving the data and after updating the record if the specified location was not included in the record prior to updating the record (Col. 5, lines 9 – 14, Willis; and Col. 28, lines 22 – 31, Black).

Regarding Claim 34, the combination of Black in view of Willis and further in view of Bakke discloses a product, wherein the first and second non-volatile storage media are located at mutually-remote sites, and wherein the instructions cause at least one of the first and second control units to transmit the data over a communication link between the sites (Col. 17, lines 9 – 12, Black; and Page 1 and 4, [0009] and [0033], lines 20 – 23 and 26 – 29; respectively, Bakke).

addition, the removing step is cited in Col. 28, line 45, Black.

Regarding Claim 35, the combination of Black in view of Willis and further in view of Bakke discloses a product, wherein the instructions cause the first and second control units to mirror the data held by the primary storage subsystem on the secondary storage subsystem (Col. 29, lines 4 – 9, Black¹⁸; and Page 1, [0009], lines 15 – 18, Bakke).

Regarding Claim 36, the combination of Black in view of Willis and further in view of Bakke discloses a product, wherein the instructions cause the secondary storage subsystem, upon occurrence of a failure in the primary storage subsystem, to serve as the primary storage subsystem so as to receive further data from the host processor to be stored by the data storage system (Page 3, [0026], lines 23 – 32, Bakke).

Regarding Claim 37, the combination of Black in view of Willis and further in view of Bakke discloses a product, wherein upon recovery of the system from a failure of the primary storage subsystem, the instructions cause the second control unit to convey, responsively to the record, a portion of the data from the second non-volatile storage media to the primary storage subsystem for storage on the first non-volatile storage media (Page 6, [0044], lines 11 – 16, Bakke).

Regarding Claim 38, the combination of Black in view of Willis and further in view of Bakke discloses a product, wherein the record comprises a bitmap, and wherein the

¹⁸ Wherein storage element corresponds to primary storage device, and destination storage element

instructions cause the first control unit to mark respective bits in the bitmap corresponding to the locations to which the data are to be written on the first and second non-volatile storage media (Col. 26, lines 20 – 25, Black¹⁹; and Page 2, [0011], lines 9 – 13, Bakke).

Regarding Claim 39, the combination of Black in view of Willis and further in view of Bakke discloses a product, wherein the instructions cause the first control unit to store (Page 27, lines 47 – 50 and 59 – 61, Black) and update the record on the first non-volatile storage media (Col. 28, lines 15 – 18, Black).

Regarding Claim 40, the combination of Black in view of Willis and further in view of Bakke discloses a product, wherein the instructions cause the first control unit to hold a copy of the record in a volatile memory of the primary storage subsystem (Col. 28, lines 7 – 8, Black), and to update the record by modifying the copy of the record (Col. 28, lines 24 – 28, Black²⁰), and destaging the modified copy of the record to the first non-volatile storage media (Col. 28, lines 24 – 25, Black²¹).

corresponds to secondary storage device.

¹⁹ Examiner interprets the step of adding a layer of mapping when the same number of bits is found, as a step for marking the bits.

²⁰ Wherein the step of updating the information containing the locations and forwarding the addresses corresponds to the step of updating the copy of the record to specify the location as claimed.

²¹ Examiner interprets the step of forwarding the new updated address (Col. 28, lines 24 – 25, Black) as the step of destaging the modified copy of the record claimed. The new updated address corresponds to the modified record. In addition, Black discloses the record of locations in the primary storage (Col. 27, lines 59 – 64, Black).

Regarding Claim 41, the combination of Black in view of Willis and further in view of Bakke discloses a product, wherein the instructions cause the first control unit not to modify the record on the first non-volatile storage media responsively to receiving the data as long as the specified location to which the data are to be written is included in the record (Col. 28, lines 7 – 11, Black).

Regarding Claim 42, the combination of Black in view of Willis and further in view of Bakke discloses a product, wherein the instructions cause the first control unit, when the specified location is not included in the record, to update the record in the first non-volatile storage media by adding a plurality of locations, including the specified location, to the record (Col. 25, lines 60 – 63, Black).

Regarding Claim 43, the combination of Black in view of Willis and further in view of Bakke discloses a product, wherein the instructions cause the first control unit, when the specified location is not included in the record, to predict one or more further locations to which the host processor is expected to write the data in a subsequent write operation (Col. 25, lines 45 – 50, Black²²), and to add both the specified location and the one or more further locations to the record (Col. 25, lines 60 – 63, Black).

Regarding Claim 44, the combination of Black in view of Willis and further in view of Bakke discloses a product, wherein the one or more further locations predicted by the

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first control unit comprise a predetermined number of consecutive locations in proximity to the specified location (Col. 25, lines 10 – 19, Black).

Regarding Claim 45, the combination of Black in view of Willis and further in view of Bakke discloses a product, wherein the instructions cause the first control unit to maintain the record using an object-based storage technique (Col. 24, lines 11 – 18, Black), and to predict the one or more further locations based on a logical connection between storage objects (Col. 24, lines 53 – 57, Black²³).

Regarding Claim 46, the combination of Black in view of Willis and further in view of Bakke discloses a product, wherein the instructions cause the first control unit, upon updating the record, to remove one or more locations, other than the specified location, from the record, so as to limit a size of the record (Col. 21, lines 53 – 57, Black).

Regarding Claim 47, the combination of Black in view of Willis and further in view of Bakke discloses a product, wherein the instructions cause the second control unit to transmit an acknowledgment to the primary storage subsystem indicating that the data have been stored in the one or more locations on the second non-volatile storage media (Col. 24, lines 58 – 62, Black), and further cause the first control unit to remove the one or more locations from the record responsively to the acknowledgment (Col. 28, line 45,

²² Examiner interprets the step of examining the table to determine the location as the step of predicting the location claimed.

²³ Wherein permitting identification corresponds to choosing the locations claimed.

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Black²⁴).

Regarding Claim 48, the combination of Black in view of Willis and further in view of Bakke discloses a product, wherein the instructions cause the first control unit to identify the locations at which the first and second non-volatile storage media contain identical data (Col. 26, lines 21 – 23, Black), and to remove from the record one of the identified locations that was least-recently added to the record (Col. 24, lines 55 – 58, Black²⁵).

²⁴ Wherein the step of releasing the memory corresponds to the step of removing the locations.

Conclusion

1. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

2. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

²⁵ Wherein examiner interprets accessed records (disclosed by Black) as added records claimed. In addition, the removing step is cited in Col. 28, line 45, Black.

Prior Art Made Of Record

1. Black (US Patent No. 6,978,324 B1, filed: June 27, 2000) discloses a method and apparatus for controlling read and write accesses to a logical entity.
2. Bakke et al. (US Patent App. Pub. No. 2003/0023808 A1, filed: July 26, 2001) discloses a method and system for maintaining data coherency in a dual input/output adapter utilizing clustered adapters.
3. Dunham (US Patent No. 6,269,431 B1) discloses a virtual storage and block level direct access of secondary storage for recovery of backup data.
4. Boothby (US Patent No. 6,799,190 B1) discloses synchronizing databases.
5. Federwisch et al. (US Patent No. 6,993,539 B2) discloses a system and method for determining changes in two snapshots and for transmitting changes to destination snapshots.
6. Non-Patent Literature: Minwen et al., "Seneca: remote mirroring done write", Proceedings of USENIX Technical Conference, (San Antonio, TX), June 2003, USENIX, Berkley, CA.
7. Willis et al. (Willis hereinafter) (US Patent No. 5,550,998).


Points Of Contact

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Giovanna Colan whose telephone number is (571) 272-2752. The examiner can normally be reached on 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Breene can be reached on (571) 272-4107. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Giovanna Colan
Examiner
Art Unit 2162
September 12, 2007


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